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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

LISH, PETER J

ART UNIT PAPER NUMBER

1754

DATE MAILED: 09/25/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

mk-5

Office Action Summary

Application No.

09/780,303

Applicant(s)

PANTER ET AL.

Examiner

Peter J Lish

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 June 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-27 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-27 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 28-38 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 06/13/01 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other:

DETAILED ACTION

Drawings

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: Detail numbers 44 and 56 are absent from Figure 3 and detail number 60 is absent from Figure 2. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Election/Restrictions

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-27, drawn to a method of carbon fiber production, classified in class 423, subclass 447.1.
- II. Claims 28-38, drawn to a furnace apparatus, classified in class 34, subclass 487; class 110, subclass 182; or class 422, subclass 285.

Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the apparatus may be used to practice another and materially different process, such as the decomposing of hazardous waste or the drying of yarns, sheets, etc. Additionally, the process as claimed may be practiced

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by another materially different apparatus which need not comply with the limitations set forth in claims 28-38, such as a heating system incorporating a conveyor belt or in which the fibers are placed in containers to be fed through a furnace.

During a telephone conversation with Eric T Jones on August 13, 2002 a provisional election was made with traverse to prosecute the invention of a method for the production of a carbon fiber, claims 1-27. Affirmation of this election must be made by applicant in replying to this Office action. Claims 28-38 withdrawn from further consideration by the examiner.

Claim Rejections - 35 USC § 112

Claims 10-12 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The term "just below" is a relative term which renders the claim indefinite. The term "just below" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim 8 rejected under 35 U.S.C. 102(b) as being anticipated by Miyamori et al. (USPN 4,389,387). Miyamori discloses a method whereby the precursor fiber is continuously drawn through a furnace in order to perform stabilization and carbonization of the fiber.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 2 and 7 rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent to Pepper et al. (USPN 4,526,770) in view of US Patent to Uchida et al. (USPN 5,733,484). Pepper discloses a means by which PAN fibers are heated in an oxidizing environment, exposed to oxygen-containing gases such as air, which is circulated throughout the furnace (column 2, lines 24-25), and under tension (column 5, lines 31-32). The fiber is then carbonized by heating in an inert atmosphere. Pepper uses the more common method of carbonizing under an inert atmosphere and does not teach the use of an oxidizing atmosphere. Uchida teaches that the carbonization can be performed even in an oxidizing atmosphere as far as it is performed at a comparatively low temperature, e.g. 400 to 600 C, within a short period of time (column 6, lines 9-12). Therefore, it would have been obvious to one of ordinary skill at the time of invention to replace the carbonization step of Pepper with that of Uchida in order to provide low temperature and short residence time.

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Further, while the carbonization process of Pepper may take place in a separate furnace, In re Japikse holds that a rearrangement of the location of parts, in this case heating zones, is obvious. It thus would have been obvious to one of ordinary skill at the time of invention to relocate the carbonization heating zone of Pepper into the same furnace as the stabilizing heating zones.

Claims 8 rejected under 35 U.S.C. 103(a) as being unpatentable over Pepper et al. as applied to claim 1 above, and further in view of US Patent to Miyamori et al. (USPN 4,389,387). While Pepper has a means by which the fiber is drawn continuously through the stabilization stage, the carbonization stage may not be continuous in so far as there are gaps in the heating elements. However, Miyamori teaches that the carbonization stage may be continuous with the stabilization stage (Figure 1). Therefore, in order to create a more continuous process, it would have been obvious to one of ordinary skill at the time of invention to apply the teaching of Miyamori in the process of Pepper.

Claim 3 rejected under 35 U.S.C. 103(a) as being unpatentable over Pepper et al. and Uchida et al as applied to claim 1 above, and further in view of US Patent to Hara et al. (USPN 4,988,492) and US Patent to Tamura et al. (USPN 5,004,511). Pepper discloses a stabilization process which involves the heating of a fiber in a gradient furnace from as much as 180 C at the entrance to 300 C at the exit (column 5, lines 64-68). He also recognizes the utility in a heating zone held at a particular temperature. However, it is Hara et al. who teach the method of holding a section of a furnace at a constant temperature for a given amount of time (Fig 2-b).

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Further, while Pepper does not disclose a definite heating rate, in a similar process Tamura teaches a heating rate of between 1 and 3 C per minute (Examples 1-2). Therefore it would have been obvious to one of ordinary skill at the time of the invention to heat the fiber within the specified temperature range, hold the fiber at a given temperature range for an amount of time, and then heat the fiber at a rate of between 1 and 3 C per minute.

Claims 4-6 rejected under 35 U.S.C. 103(a) as being unpatentable over Pepper et al. and Uchida et al. as applied to claim 1 above, and further in view of US Patent to McCullough (USPN 5,700,573). McCullough teaches a means to produce bioregional fibers from a homogenous polymeric material whereas the outer fiber portion of the polymeric material is oxidation stabilized and then carbonized to form two distinct regions in the fiber, the homogenous polymeric fiber preferably being a standard acrylic polymer. (column 3, lines 14-30). Because this process is carried out under similar conditions to the production of single region carbon fibers, it would have been obvious to one of ordinary skill at the time of invention to include the partial oxidation and carbonization method of McCullough in the process of Pepper in order to produce biregional fibers.

Claims 9, 13, 21, 23 and 24 rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent to Miyamori (4,389,387) in view of US Patent to Uchida et al. (USPN 5,733,484). Miyamori discloses a means by which fibers are continuously heated in an oxidizing environment under tension and then carbonized by heating in an inert atmosphere. While Miyamori uses the more common method of carbonizing under an inert atmosphere, Uchida

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teaches that the carbonization can be performed even in an oxidizing atmosphere as far as it is performed at a comparatively low temperature, e.g. 400 to 600 C, within a short period of time (column 6, lines 9-12). Therefore, it would have been obvious to one of ordinary skill at the time of invention to replace the carbonization step of Miyamori with that of Uchida in order to provide low temperature and short residence time.

Miyamori also uses a furnace which comprises independent heating zones. In re Japinkse holds that the relocation of these heating zones into separate furnaces is obvious. Thus it would have been obvious to one of ordinary skill at the time of invention to provide for separate furnaces in order to create independent heating zones.

Miyamori teaches that "the transferring velocity of the net-belt conveyer (or draw rate) relates to the size of the infusibilization furnace and is optionally variable, and usually it is designed to have the residence time of 1 to 4 hours in the furnace. The velocity usually used is 0.5 to 50 m/hr" (column 6, lines 30-35). Thus, the residence time and draw rates are controlled and adjusted as needed.

Regarding claim 23, it is seen in the process of Miyamori that the fiber remains enclosed as it passes from heating zone to heating zone. As a relocation of the heating zones into separate furnaces is obvious, keeping the fiber enclosed within a series of furnaces would have been obvious to one of ordinary skill at the time of invention.

Claim 10-12 rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent to Miyamori (4,389,387) in view of US Patent to Uchida et al. (USPN 5,733,484) as applied to claim 9 above, and further in view of US Patent to Berkebille et al. (USPN 5,316,654). Miyamori

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teaches the heating of a fiber to subsequently higher temperatures. He also recognizes the need to stay below the softening point, staying always between 5 and 50 C below it. Berkebile, however, teaches a process where a single heating zone is held close to the softening point. In this process, the fiber is held at 11 C below the "glass transition temperature", or "the highest temperature allowable for satisfactory stabilization" (column 6, lines 66-69) for about 50 minutes. The fiber is then heated at a temperature of 200 C for 30 minutes, 265 C at 10 minutes, and finally 305 C for 10 minutes (column 6, lines 10-29). Thus it would have been obvious to one of ordinary skill at the time of invention to heat the fiber to just below its softening point in one furnace only, where it would be held for the longest amount of time, rather than constantly keeping it near the softening temperature as in Miyamori.

Claims 14-17, 20, and 27 rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent to Miyamori (4,389,387) in view of US Patent to Uchida et al. (USPN 5,733,484) as applied to claim 9 above, and further in view of US Patent to Pepper (USPN 4,526,770). While Miyamori teaches the heating of a fiber in an oxidizing atmosphere, he merely specifies that the temperature be kept under 300 C. Pepper, however, teaches that the temperature of heating a PAN fiber should fall only between 180 C at the beginning to 300 C at the exit. He also distinguishes that the oxidizing gas may be air. It therefore would have been obvious to one of ordinary skill at the time of invention to heat a PAN fiber using the process of Miyamori under this narrower range of temperatures and using air as the oxidizing gas because doing so provides the desired carbonization.

Concerning claim 16, while Miyamori states that the residence time is preferably between 1 and 4 hours, Pepper teaches a residence time of between .5 and 120 minutes. Thus the claimed stabilization residence time of 4.2 minutes (.6 minutes per stage x 7 stages) clearly falls within this range. It therefore would have been obvious to one of ordinary skill at the time of invention to apply the residence time in connection with the temperature range to the process of Miyamori.

Concerning claim 20, Miyamori speaks nothing of a graphitization step in the preparation of his fiber. However, it is taught by Pepper that the carbonized fibers may then be further heated and graphitized (column 5, lines 54-55) in order to increase the strength and modulus of the fiber. It thus would have been obvious to one of ordinary skill at the time of invention to include this step in the process of Miyamori.

Claims 18-19 rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent to Miyamori (4,389,387) in view of US Patent to Uchida et al. (USPN 5,733,484) as applied to claim 9 above, and further in view of US Patent to Schulz (USPN 4,032,607). While Miyamori does not disclose a method of lowering the gaseous flowrate through the furnace at higher temperatures, Shultz teaches the rate of flow of the gas should be independently controlled in each zone of the oven to allow gas flow to be regulated as desired (column 7, lines 55-58). Therefore, it would have been obvious to one of ordinary skill at the time of invention to adjust gas flow as needed.

Claim 22 rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent to Miyamori (4,389,387) in view of US Patent to Uchida et al. (USPN 5,733,484) as applied to claim 9 above,

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and further in view of US Patent to Paul Jr. (USPN 5,268,158). While Miyamori teaches the enclosed movement of a fiber between a plurality of heating zones, Paul Jr discloses a means by which the fiber is transported between heating zones while being exposed to ambient air. The precursor that is undergoing oxidation in a plurality of ovens is passed around rollers positioned in steps on either side of the exterior of each oven. (column 4, lines 30-35). Therefore, it would have been obvious to one of ordinary skill at the time of invention, in order to allow a cooling, oxidizing environment, to replace the enclosed transport between furnaces with an external transport.

Claim 25-26 rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent to Miyamori (4,389,387) in view of US Patent to Uchida et al. (USPN 5,733,484) as applied to claim 9 above, and further in view of US Patent to McCullough (USPN 5,700,573). McCullough discloses that biregional carbon fibers can be produced by "limiting the extent of stabilization to an outer region of the fibers" (column 5, lines 30-33) and subsequently "by carbonizing only the portion of each fiber which has been oxidatively stabilized" (column 5, lines 37-39). McCullough also teaches the use of a bipolymeric fiber whereas the core is formed of one fiber and the outer sheath of another, such that the outer sheath can be oxidized and carbonized in accordance with the same process conditions (column 13, lines 9-29). Because this process is carried out under similar conditions to the production of single region carbon fibers, it would have been obvious to one of ordinary skill at the time of invention to include the partial oxidation and carbonization method of McCullough in the process of Miyamori in order to produce biregional fibers.

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Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Peter J Lish whose telephone number is 703-308-1772. The examiner can normally be reached on 9:30-6:00 Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on 703-308-3837. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-305-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

PL
September 19, 2002



STUART L. HENDRICKSON
PRIMARY EXAMINER